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*Indian Standard*

# GUIDELINES FOR PACKING, STOWAGE AND SECURING OF CARGO INSIDE THE FREIGHT CONTAINER

## PART 1 GENERAL CARGO

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INDIAN STANDARDS INSTITUTION
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# *Indian Standard*

# GUIDELINES FOR PACKING, STOWAGE AND SECURING OF CARGO INSIDE THE FREIGHT CONTAINER

## PART 1 GENERAL CARGO

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# *Indian Standard*

# GUIDELINES FOR PACKING, STOWAGE AND SECURING OF CARGO INSIDE THE FREIGHT CONTAINER

## PART 1 GENERAL CARGO

## 0. FOREWORD

**0.1** This Indian Standard ( Part 1 ) was adopted by the Indian Standards Institution on 30 September 1985, after the draft finalized by the Freight Containers Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

**0.2** This standard is intended as a guide to the essentials of safe packing for use by those responsible for the packing and securing of cargo in freight containers. Earlier, the securing of cargo on boardships was done by the skilled stevedore labour. Now it is the responsibility of the shipper who does the loading and securing of goods inside the container at factory of warehouse, often with less skilled manpower.

**0.3** Damage to goods transmitted in containers is usually due to more faulty stowing and securing than due to severe stresses during transportation. Therefore, it is necessary to prevent cargo shifting within the container which may cause damage to the container and/or to the cargo.

**0.4** While this part of the standard deals with general cargo, the guidelines for packing, stowage and securing of dangerous goods inside the freight container are given in the Part 2 of this standard.

**0.5** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values ( *revised* ).

## 1. SCOPE

**1.1** This standard ( Part 1 ) gives guidelines for safe packing, stowage and securing of general cargo in a freight container.

## 2. FORCES ACTING ON CARGO

**2.1 During Road Transport** — Once cargo is loaded inside a container and when the container moves by road, following hazards exist:

a) Impact against loading docks,

b) Braking and acceleration,

c) Sway on curves,

d) Coupling impact, and

e) Vibration and shocks.

**2.1.1** Rapid acceleration and deceleration from sudden stops can create forces ranging from 3 to 8 'G' ( gravity ). This places a tremendous strain on individual pieces as well as the entire load. When the cargo bounces inside a container 'G' forces can be severe specially on loads at the rear of the container. It also experiences horizontal centrifugal forces during turning and cornering.

**2.2 During Rail Transport**

a) Acceleration and deceleration,

b) Coupling impact,

c) Sway on curves, and

d) Vibrations.

**2.2.1** Movement of container on land at times is accomplished through rail transportation and the goods are subjected to the same stresses as in the case of truck ( highway ) transportation. In addition, hard braking can occur during shunting. This creates retardation, a sudden force and aft movement of cargo.

**2.2.2** Shocks and vibrations produced in rail movements are greater than those of the road transportation. It is not unusual to have frequencies of 2·5 to 5 hertz with shock intensities of up to 1·25 Gs.

**2.3 During Sea Voyage** — A vessel at sea may be subjected to extreme weather conditions.

**2.3.1** A ship has the following movements of rotation about its axis ( *see* Fig. 1 ):

a) Rolling,

b) Pitching, and

c) Yawning.

**2.3.2** A ship has also the following body motions as shown in Fig. 1:

a) Heave,
b) Sway, and
c) Surge.

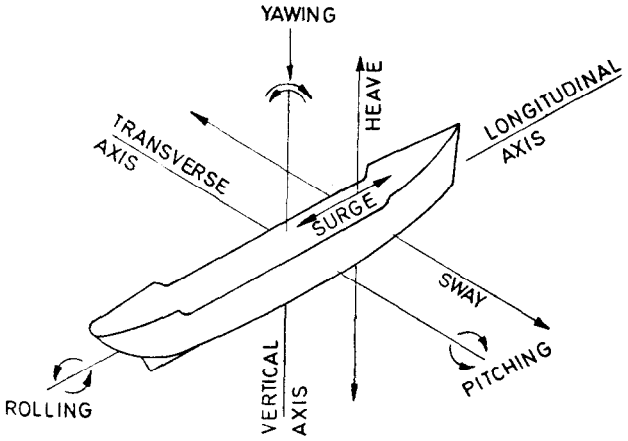


FIG. 1 BODY MOTION

**2.3.3** A ship may move in a single motion or in any combination of all of these motions at one instance making it a confusing and extremely complex action.

**2.3.4** A loaded container may travel 21 metres with each complete roll as often as 7 to 10 times per minute. In high seas a roll of 45° is not uncommon. The toughest leg of the journey of a container is the sea and the cargo in the container should be loaded and secured to withstand this toughest journey.

## 3. GUIDELINES FOR VISUAL EXAMINATION OF THE CONTAINER

The container should be inspected both inside and outside, before it is loaded with cargo. Containers that are damaged, may pose a risk to the personnel handling or transporting them. If a container appears to be severly damaged, the container operator should be contracted with a view to obtain replacement. The following checklist may be used as a guide to inspect the container before loading of cargo is started.

### 3.1 Interior

**3.1.1** The container should be free from major damage or broken floor planks or protrading nails that can damage the cargo.

**3.1.2** The container should be clean, dry and free of residue and persistant odours from previous cargoes.

**3.1.2.1** If the container has been used for the transportation of goods with a pungent or obnoxious smell or germinating cargoes, internal cleaning or even disinfection may be necessary.

**3.1.3** The container should be weather proof ( unless it is so constructed that this is obviously not required, that is flats ). The risk of water leaking into the container may be checked by entering the container, closing the doors and seeing if any light comes through. In particular, previous patches or repairs should be checked for possible leakage. If this type of checking is carried out, care should be taken to ensure that a person does not inadvertantly get locked inside.

**3.1.4** Ventilation openings, if fitted should be securely closed unless specifically instructed otherwise.

**3.1.5** Most of the dry freight containers have built-in tie-down on fittings ( bull rings/D rings ) which are used to secure and brace on cargo inside the container. These tie-down on fittings, where provided, should be in good condition and well anchored.

**3.1.6** Folding containers or other containers with movable or removable main components should be correctly assembled. Care should be taken to ensure that removable parts, not in use, are packed and secured inside the container.

### 3.2 Exterior

**3.2.1** The doors of the container should be checked to see that they work properly and can be securely locked and sealed. Door gaskets and weather strips should be checked to see that they seal tightly upon closing the doors.

**3.2.2** The corner fittings usually on both the top and bottom of the container are extremely important for the safe handling and transportation of the container. They should be free of damage and there should be no visible cracks.

**3.2.3** It is important that the walls, floor and roof are in good condition, intact and not distorted.

**3.2.4** The structural strength of the container depends to a great extent on the metal bottom and top rails and vertical posts which form the frame of the container. If they are bent this may be evidence that the container is severely weakened and should not be used.

## 4. GUIDELINES ON THE STOWING, PACKING AND SECURING OF GOODS IN A CONTAINER

### 4.1 Before Packing

**4.1.1** When a container on a vehicle is manoeuvered up to a loading dock or bay, the vehicle's brakes should be applied or wheels checked before loading of the container begins. If a container on a semi-trailer is positioned, at a loading bay and the tractor unit is removed, trailer may become unstable and pivot about trailer landing legs during the loading process, particularly, if a forklift truck is used inside the container. In such circumstances a suitable prop should be positioned under the fifth wheel plate of the trailer.

**4.1.1.1** When forklift trucks are used, the dynamic load on the floor of the container due to the forklift truck shall be limited as follows:

| | |
|---|---|
| Front axle mass | 5 460 kg, *Max* |
| Mass per front wheel | 2 730 kg, *Max* |
| Contract area/wheel | 142 $cm^2$, *Min* |
| Wheel width | Not less than 180 mm |
| Wheel centres | About 760 mm |

**4.1.2** Loading pattern should be planned for each commodity prior to commencement of loading in container. The pre-planning leaves the minimum gap inside the container and avoids overloading one end of the container or the container sides.

**4.1.2.1** The maximum permissible intensity of loading should not exceed the following limits:

| | |
|---|---|
| For 20-ft container | 4·5 ton/$m^2$ |
| For 40-ft container | 3 ton/$m^2$ |

**4.1.2.2** Cargo packages of an appropriate strength and type should be selected to be placed adjacent to each other, so as to gain the desired tightness of stowage and compatibility between the items.

**4.1.3** The planned load of the container should not exceed the container's weight capacity which is usually marked on the container. In addition, the relevant highway or road axle weight limitations in the countries of loading, destination or transit, should not be exceeded.

**4.1.4** When cargo comprises heavy units, it may be necessary to spread their weight over the container floor using timber, steel plates or other arrangements. In this regard, the size of the bearing area upon which the weight presses against the floor in relation to the design strength of the container is the most important factor.

**4.1.5** Unboyed machinery should be belted on a skid made of sound timbers so that the lower members extend length-wise in the container for the proper distribution of weight.

**4.1.6** Particular care should be taken when securing heavy units within a container to prevent their movement. Batten nailed to wood floor ( where fitted ), securing against corner post or longitudinal rails, lashings to the built-in securing points or combination of any of these should be used to ensure proper securing of the cargo.

**4.1.6.1** Portable anchor plates are available which can be placed and secured at strategic locations depending on the cargo to be lashed.

## 4.2 Packing and Securing

**4.2.1** It is essential to make the cargo in the container secure against movement from any reasonable cause and, therefore, all cargo should be blocked tightly against adjacent goods or surfaces.

**4.2.2** In the first instance, it is best to obtain a tight stowage by using the cargo itself and building with a reasonable solidity from side-wall to side-wall. This may mean some space has to be left but each item should be in contact with some part or the other. If this cannot be the case, intervening spaces should be filled with appropriate dunnage material, that is, timber folded, cardboard, hardboard, air bags, etc. Where timber is used, due account should be taken of any quarantine regulations applying in the country of destination.

**4.2.3** Cargo weight should be evenly distributed over the floor of the container. Where cargo items of varying weight are to be packed into a container or where the container will not be full ( either because of insufficient cargo or because the maximum weight allowed will be reached before the container is full ), then the stowage should be arranged and secured in such a manner that the approximate centre of gravity of the cargo is close to the mid length of the container. In no case, more than 60 percent of the load should be in less than half of the length of the container.

**4.2.3.1** Longitudinally, the centre of gravity may be out of middle by the following limits:

| | |
|---|---|
| 20-ft container | ±0·60 m |
| 40-ft container | ±0·90 m |

**4.2.4** Heavy goods should not be placed on top of lighter goods. Wherever possible, the centre of gravity should lie in the lower half of the height. Cargo with high centre of gravity shall require more decking and bracing in a container than the one with a lower centre of gravity.

**4.2.5** Stowing of incompatible goods in the container should be avoided. For example, dust producing goods, such as cement should not be stowed next to or on top of goods which are susceptible to damage by dust, that is, foodstuffs or fine machinery.

**4.2.5.1** Goods with sharp projections or unusual shapes should be stowed apart from other type of packages, particularly bags. If possible, separation timber should be used to avoid damage.

**4.2.6** Barrels and drums should usually be packed with bungs uppermost. Proper stowage for barrels is on their side, laid on battens with bulge free and each securely cushioned. Vented packages should be packed so that the vent is in no way blocked.

**4.2.7** In order to avoid cargo damage from condensation, wet cargoes, moisture inherent cargo, or cargoes liable to leak must not be loaded with goods susceptible to damage by moisture. Wet dunnage, pallets or wet packaging should not be used.

**4.2.8** Damaged packages should not be loaded into a container unless there is clear evidence that the contents will not spill or leak.

**4.2.8.1** In case, the packages develop leakage during voyage, in order to avoid damage in that case double tier of dunnage keeps cargo off the floor and above the pool of liquid.

**4.2.9** When solids and liquids are stowed in the same container, solids should always be placed above the liquids to avoid possibility of damage from leakage.

**4.2.10** Permanent securing equipment incorporated in the design of the container should be used wherever necessary to obtain tight stowage and prevent cargo movement.

### 4.3 On Completion of Packing

**4.3.1** After the packing of the container is completed, steps should be taken to ensure that the cargo will not fall out when the doors are opened. Suitably positioned lashing points and wire rope or strapping hands should be used to leave a restraining net across the face of the cargo or a gate should be positioned to prevent direct pressure on the door. Where medium sized packages are concerned, care should be taken to interweave the cargo itself so as to effectively build a wall and thus reduce the need for a reliance opened lashings or net alone.

**4.3.2** If goods are packed in wooden receptacles or wood is used for securing purposes and the goods are destined for countries having wood treatment quarantine regulations, it is a desirable practice to place a copy of the wood treatment certificate in a conspicuous place in the container.

# INTERNATIONAL SYSTEM OF UNITS ( SI UNITS )

**Base Units**

| Quantity | Unit | Symbol |
|---|---|---|
| Length | metre | m |
| Mass | kilogram | kg |
| Time | second | s |
| Electric current | ampere | A |
| Thermodynamic temperature | kelvin | K |
| Luminous intensity | candela | cd |
| Amount of substance | mole | mol |

**Supplementary Units**

| Quantity | Unit | Symbol |
|---|---|---|
| Plane angle | radian | rad |
| Solid angle | steradian | sr |

**Derived Units**

| Quantity | Unit | Symbol | Definition |
|---|---|---|---|
| Force | newton | N | 1 N = 1 kg.m/s$^2$ |
| Energy | joule | J | 1 J = 1 N.m |
| Power | watt | W | 1 W = 1 J/s |
| Flux | weber | Wb | 1 Wb = 1 V.s |
| Flux density | tesla | T | 1 T = 1 Wb/m$^2$ |
| Frequency | hertz | Hz | 1 Hz = 1 c/s ($s^{-1}$) |
| Electric conductance | siemens | S | 1 S = 1 A/V |
| Electromotive force | volt | V | 1 V = 1 W/A |
| Pressure, stress | pascal | Pa | 1 Pa = 1 N/m$^2$ |